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ECLIPSES OF *JUPITER'S* SATELLITES, P. S. T.

(Off right-hand limb, as seen in an inverting telescope.)

		H. M.			H. M.
I, R,	June 2.	6 39 P. M.	II, D,	June 18.	11 33 P. M.
II, R,	4.	8 45 P. M.	I, R,	23.	11 23 P. M.
I, R,	8.	1 5 A. M.	I, R,	25.	5 52 P. M.
I, R,	9.	7 34 P. M.	III, D,	28.	5 41 P. M.
II, D,	11.	8 56 P. M.	III, R,	28.	8 1 P. M.
II, R,	11.	11 22 P. M.	II, R,	29.	5 51 P. M.
I, R,	16.	9 29 P. M.			

LIST OF EARTHQUAKES IN CALIFORNIA FOR THE YEAR 1897.

COMPILED BY C. D. PERRINE.

The following list is a continuation of similar reports printed in these *Publications:* Vol. II, p. 74; Vol. III, p. 247; Vol. V, p. 127; Vol. VI, p. 41; Vol. VII, p. 99; Vol. VIII, p. 222, and Vol. IX, p. 37. A more complete account will be published by the Unites States Geological Survey as a bulletin. The dates are civil dates. The times are Pacific Standard (120th meridian).

Roman numerals enclosed in parentheses indicate the intensity on the ROSSI-FOREL scale.

Some doubtful cases have been included, and are indicated either by a note or by an interrogation point enclosed in parentheses.

In 1897 there were twenty-five shocks of earthquake recorded in California as against sixteen for the year 1896.

The shock of June 20th was accurately timed at Mt. Hamilton and Oakland, and as we know approximately the center from which the disturbance radiated, we can obtain the velocity over this part of its path. At Mt. Hamilton the beginning was noted at $12^h\ 12^m\ 56^s$ P.M., P. S. T., by several observers, and Mr. BABCOCK obtained $12^h\ 13^m\ 9^s$ as the time of the same phase in Oakland, an interval of thirteen seconds. Assuming the epicentrum to have been between San Juan and Salinas, we find Mt. Hamilton to be forty miles from this point, while Oakland is eighty miles. As both points lie nearly in the same direction from the origin of the disturbance, differing only twenty degrees, we may assume that the disturbance moved with the same velocity towards both stations, from which we find the velocity between Mt. Hamilton and Oakland to be $3\frac{1}{10}$ miles per second.

This is an unusually high velocity, and in this connection it will be interesting to note the intervals in the cases of other shocks, which have been timed with sufficient accuracy.

1889.	July	31.	L. O.-East Oakland,	$+\ 11^s$
			L. O.-San Francisco,	$+\ 7^s$
1890.	April	24.	San Francisco-San José (U.P.),	$-\ 40^s$
	May	11.	San Francisco-East Oakland,	$\pm\ 0^s$
1891.	January	2.	L. O.-San Francisco,	$-\ 22^s$
			L. O.-San José,	$-\ 12^s$
	June	28.	L. O.-San Francisco,	$-\ 10^s$
	October	11.	San Francisco-Oakland,	$-\ 17^s$
1892.	April	19.	L. O.-Carson, Nev.,	$-\ 70^s\pm$
	April	21.	San Francisco-Reno, Nev.,	$-\ 107^s$
1896.	July	26.	L. O.-San Francisco,	$+\ 15^s$

The April, 1892, shocks had their origin in the great central valley of California, and we may safely take a point near Vacaville as the epicentrum of both disturbances. Assuming that the velocity was the *same at equal distances from this point*, we find, for the shock of April 19th, an average velocity of 0.8 miles per second for a distance of fifty-six miles from Carson, Nevada, measured towards the center of disturbance. The interval of time of seventy seconds is somewhat uncertain, perhaps ten seconds or fifteen seconds. For the shock of April 21st, we find an average velocity of 0.8 miles for ninety miles from Reno.

The epicentra for the other cases are entirely too uncertain to base any velocities upon.

List of Earthquake Shocks, 1897.

January 1. Berkeley, 1:10 P.M.
January 11. Oaxaca (Mexico), 4:25 P.M.
January 16. Mt. Hamilton, $3^h\ 58^m\ 38^s$ A.M. (I).
January 17. San Francisco, $1^h\ 9^m$ P.M.; Alameda, $1^h\ 11^m$ P.M.; Oakland, $1^h\ 11^m\ 11^s$ P.M. (A. H. B.), $1^h\ 10^m\ 55^s \pm 2^s$ (G. R. L.); Mills College, $1^h\ 11^m$ P.M.
January 26. Newport, Alsa Bay (Oregon), $2^h\ 45^m$ P.M.
February 2. Tomales.
February 5. Orizaba Volcano (Mexico).
February 13. Colima, Tepic (Mexico).

February 18. Mt. Hamilton, $8^h\ 3^m\ 52^s \pm 5^s$ P.M. (I) C. D. P.; $8^h\ 4^m\ 30^s \pm$ P.M. (II) E. S. H.

The above are two separate shocks. C. D. P.

February —. Cacaluta (Mexico).

February —. Great Salt Lake (Utah). (?)

March 6. Acapulco, Vera Cruz, Oaxaca, Orizaba, Cordoba (Mexico), $7^h\ 30^m$ P.M.

March 13. Mt. Baker (Wash.) (?)

March 15. Ukiah, 11^h P.M.

March 15. Highland Springs, Pieta, Lakeport, $10^h\ 51^m$ P.M. Reported by Mr. WM. B. COLLIER.

April 10. Mexico, south of Oaxaca.

May 14. Moro Bay. (?)

May 14. Reno (Nevada), 6 P.M.

May 15. San Diego, 4 A.M.; Carson (Nevada), 11:04 A.M.

May 22. San Diego, 6:58 A.M.

June 20. A heavy shock of earthquake was felt generally throughout the central portion of California shortly after noon. The center of the disturbance seemed to be in the Salinas Valley. Considerable damage was done to buildings in towns in this and neighboring valleys. Mt. Hamilton, $12^h\ 12^m\ 56^s$ (beginning). Duration, 20^s–30^s (V); College Park; Mills College, reported by Professor KEEP; Oakland, $12^h\ 13^m\ 9^s$ to $13^m\ 34^s$ P.M., reported by Mr. A. H. BABCOCK; Cantua Creek (Fresno Co.), reported by Mr. S. C. LILLIS; San José; Gilroy; Hollister; Salinas; Los Gatos; Santa Cruz; Templeton; Monterey; Pacific Grove; Stockton; Modesto; Newman; Merced; Visalia; Milton; Santa Rosa; Haywards; Decoto; Sacramento; Watsonville; Hanford; San Francisco, 6:37 A.M., 12:15 P.M., 12:48 P.M.; Gonzales; Fresno; Redwood City; San Rafael.

June 20. Tehuantepec (Mexico).

June 21. Gilroy, 5:15 A.M.; Salinas.

June 24. Santa Barbara, 6:10 A.M.

June 26. Tehuantepec (Mexico).

June (26 ?). Douglas Island (Alaska). Volcano.

June (27 ?). "Saw Mill" Peak, Butte Co. (?)

July 19. Santa Barbara, 11:45 P.M.

July 26. Mt. Hamilton, $5^h\ 40^m\ 50^s$ P.M. (III) E. S. H.; San Francisco, $5^h\ 40^m\ 35^s$ P.M., reported by Professor GEORGE DAVIDSON; Berkeley; Oakland.

September 27. Olympia (Wash.), 1:30 A.M.
October 2. College Park, $8^h\,41^m\,57^s.3$ A.M., reported by Professor H. D. Curtis; San Francisco.
October 5. Stockton, 7:44 P.M.
October 17. Mt. Hamilton, $3^h\,30^m\,26^s$–31^s P.M. (III); San José.
November 21. Randsburg, 11:30 A.M.; 12:30 P.M.
December 6. Forest Grove (Oregon), 8:30 P.M.
December 10. Mt. Hamilton (in night).
December 15. Waterville, Lakeside (Wash.).
December 16, 17, 20. Lakeside (Wash.), 6 A.M.
December 23. Mills College, 5:15 A.M. Reported by Professor Keep.
December 26. Centerville, 7:06 A.M.

LATITUDE WORK WITH THE FAUTH TRANSIT INSTRUMENT OF THE LICK OBSERVATORY.

By Heber D. Curtis.

At the suggestion of Dr. Holden, I last summer entered upon a trial of the four-inch Fauth transit of the Lick Observatory to determine its value as a zenith telescope for finding the latitude.

The latitude level found in place upon the transit was rejected because of irregular curvature. After tests on all the level-tubes in the possession of the observatory, the tube "Repsold, No. 1491" was selected as being the most regular. Nearly six hundred readings were made on the Repsold level-trier belonging to the observatory, to determine the value of the division of this level, at temperatures ranging from 45° to 83° F. It was found to be a tube of very regular curvature.

In reversing the transit with the aid of the carriage, it is necessary to place the telescope in a horizontal position, thus bringing the level-tube to a position greatly inclined to the horizon, invariably shortening or lengthening the bubble, and making it necessary to bring back the bubble to a more moderate length. It therefore became necessary to determine whether any factor of change in the value of a level division could be found to depend upon change in bubble length. Accordingly the length of the